SHARP

SCIENTIFIC CALCULATOR

MODEL **EL-506P**

INSTRUCTION MANUAL

(ELECTRONIC CALCULATOR)
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SHARP ELECTRONICS CORPORATION warrants this product to the original purchaser to be free from defective materials and workmanship. Under this warranty the product will be repaired or replaced, at our option, without charge for parts or labor, with the exception of batteries, when returned to a SHARP CONSUMER FACTORY SERVICE CENTER listed in the instruction booklet supplied with your unit.

This warranty does not apply to any appearance items nor to any products whose exterior has been damaged or defaced, nor to any products subjected to misuse, abnormal service or handling, nor to any products altered or repaired by other than a SHARP CONSUMER FACTORY SERVICE CENTER. This warranty does not apply to any product purchased outside the United States, its territories, or possessions.

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CONTENTS

	Page
INTRODUCTION	4
OPERATIONAL NOTES	4
FEATURES	6
NORMAL CALCULATIONS	9
1. Addition, Subtraction	10
2. Multiplication, Division	12
3. Use of parenthesis.	14
Priority Level	15
4. Memory Calculations	19

Page

SCIENTIFIC CALCULATIONS 21
1. Second Function 21
2. Scientific Notation 23
Decimal Places. 23
3. Trigonometric Functions. 25
4. Inverse Trigonometric Functions 26
5. Hyperbolic and Inverse Hyperbolic Functions. 26
6. Power Functions 27
7. Roots. 27
8. Logarithmic Functions 28
9. Exponential Functions 28
10. Reciprocals 29
11. Factorial 29
12. Percent Calculations 30

Page
13. Random Number Generation 30
14. Angle/Time Conversions 31
15. Coordinate Conversion 33
16. Applications 35
COMPLEX NUMBER CALCULATIONS 38
BINARY, OCTAL AND HEXADECIMAL NUMBER CALCULATIONS 44
STATISTICAL CALCULATION 54
ERRORS 58
THE KEYBOARD 68
OPERATING CONTROLS 70
DISPLAY 83
BATTERY REPLACEMENT 88
SPECIFICATIONS 90

INTRODUCTION

Thank you for your purchase of the SHARP scientific calculator, model EL-506P.

This manual will introduce you to the Sharp EL-506P scientific calculator.
Each section in this manual may be divided into basic and advanced material. The advanced material is labeled "supplementary." The supplementary sections may be skipped without hampering your ability to operate the calculator. You may wish to return to the supplementary sections as your skill in operating the EL-506P increases.

OPERATIONAL NOTES

Since the liquid crystal display is made of glass material, treat the calculator with care.

To insure trouble-free operation of your SHARP calculator, we recommend the following:

1. The calculator should be kept in areas free from extreme temperature changes, moisture and dust.
   During warm weather, vehicles left in direct sun light are subject to high temperature build up.
   Prolonged exposure to high temperature may cause damage to your calculator.
2. A soft, dry cloth should be used to clean the calculator. Do not use solvents or a wet cloth.
3. If the calculator will not be operated for an extended period of time, remove the batteries to avoid possible damage caused by battery leakage.
4. If service of your calculator is required, use only an authorized SHARP service center.
5. Keep this manual for further reference.

FEATURES

1. Scientific Functions

- **Direct formula entry**

Direct formula entry for entering formulas as they are written with no need for translation into machine language.

Example $5 + 2 \times \sin 30 + 24 \times 5^3 = 3006$

Operation [5] [+] [2] [×] [3] [0] [sin] [+] [2] [4]
[×] [5] [y^x] [3] [=]

15 levels of parentheses and 4 levels of pending operations for solving more complicated formulas.

- **Binary, Octal, and Hexadecimal Calculations**
  Binary, Octal, and Hexadecimal numbers are mainly used in computer programming. Computer engineers and programmers have been in urgent need for a simple conversion and calculation of Binary, Octal, and Hexadecimal numbers. Now EL-506P has solved the problem. Simply enter numbers in base 2,8, or 16, the EL-506P will then give you the answer instantly.
- **Complex Number Calculations**
  The EL-506P allows you to calculate complex numbers which are often used for electrical or mathematical calculation. When combined with the coordinate conversion feature, the complex number calculation feature lets you calculate the absolute value of complex numbers, deviation angles, and vector composition.
- **Preprogrammed for 56 Functions**
  Trigonometric, inverse trigonometric, logarithmic, hyperbolic, inverse hyperbolic, statistical, random number generation and others.

2. Useful Keys for Solutions of Math Problems

- Statistical calculations with statistical mode [STAT], number of samples/Σx [n Σx], mean/Σx^2 [$\bar{x}$ Σx^2], standard deviation [s σ], enter data/correct data [DATA CD] keys.
- Independently accessible memory. (x→M , RM , M+)
- DEG/RAD/GRAD selector key. (DRG)$_{\text{DRG}\blacktriangleright}$
- Angular unit conversion key. (2ndF DRG)
- Degree/Minute/Second conversion key for decimal degree transformation. ($^{\blacktriangleright\text{D.MS}}$ ▸DEG)

NORMAL CALCULATIONS

TURNING THE POWER ON [ON/C]

To turn the power on press the red [ON/C] key. To turn the power off press the [OFF] key. Sharp calculator has the A.P.O. (Automatic Power OFF). If the calculator is turned on in error, or no calculation is performed, the calculator will turn itself off after about 10 minutes, saving battery power. To turn the EL-506P back on press the [ON/C] key.

EL-506P can designate the decimal places of an answer. To floating decimal system in this chapter, depress the [2ndF], [TAB F↔E] and [•] keys. (Details, see "Decimal Places")

CLEARING

[CE], [→]

An incorrectly entered number can be replaced as long as the number has not already been followed by a "function key." Pressing the clear entry key will clear the latest entry while retaining all previous entries.

For example:

Key in: 5 [×] 4 (The 4 should be 6)

Key in: [CE] 6 [=]
Answer: 30

If the [ON/C] key is pressed the calculator will be cleared except for material in memory.
In case of one digit correction of the entered number, use the right shift key.
Key in: 123 [+] 12345687 (The 87 should be 78)
Key in: [→] [→] 78 [=]
Answer: 12345801

BASIC FUNCTIONS AND THE EQUALS KEY

[+] [−] [×] [÷] [=] Addition, Subtraction, Multiplication, Division, Equals

1. Addition, Subtraction

Key in: 123 [+] 456 [+] 789 [=] Answer: 1368
Key in: 100 [−] 25 [−] 35 [=] Answer: 40

Pressing the [=] key gives the answer to the entered formula.

Using a constant:

The calculator is equipped with a built-in constant feature which allows repetitive calculations (calculating with the same number without having to re-enter that number and the function key).

Key in: 10 [+] 20 [=] Answer: 30

20 is now a constant for further additions:

Key in: 60 [=] Answer: 80

> Some calculations require slightly longer time depending on the contents. If nothing appears on the display during calculation do not continue making entries.

To use the sum of numbers as a constant use [(] and [)] keys.

Key in: 10 [+] [(] 20 [+] 5 [)] [=] Answer: 35

Key in: 4 [=] Answer: 29

Key in: 100 [−] 25 [=] Answer: 75
Key in: 40 [=] Answer: 15
Key in: 50 [−] [(] 10 [−] 2 [)] [=] Answer: 42
Key in: 20 [=] Answer: 12

2. Multiplication, Division

Calculate: $50 \times (-2) \div 4$

Key in: 50 [×] 2 [+/−] [÷] 4 [=]

Note: To enter a negative number, press the [+/−] key after numerals.

Answer: −25

Calculate: $5 + 2 \times 3 - 2 \div 0.5$

Key in: 5 [+] 2 [×] 3 [−] 2 [÷] .5 [=]

Answer: 7 ↑—(Press [•])

Note that multiplication and division have priority to addition and subtraction. In other words multiplication and division will occur before addition and subtraction.

Constant Multiplication: The first number entered is the multiplicand.

Key in: 3 [×] 5 [=] Answer: 15

Key in: 10 [=] Answer: 30

Constant Division: The number entered after the division sign is the divisor.

Key in: 15 [÷] 3 [=] Answer: 5

Key in: 30 [=] Answer: 10

Note: The machine retains some calculations depending on priority level. Accordingly, in successive calculation the operator of the last calculation and the last numerical value are handled as a calculating instruction and a constant for constant calculation, respectively. (except constant multiplication)

$a \underline{+ b \times c} =$ $+bc$ (Constant addition)

$a \times b \underline{\div c} =$ $\div c$ (Constant division)

$a \times b \underline{- c} =$ $- c$ (Constant subtraction)

In constant multiplication the first numerical value is handled as a constant.

$\underline{a \div b \times} c =$ $\frac{a}{b} \times$ (Constant multiplication)

3. Use of parenthesis

The parentheses keys are needed to cluster together a series of operations when it is necessary to override the priority system of algebra. When parentheses are in use on the EL-506P the symbol ( ) will appear in the display.

Calculations in parentheses have priority over other calculations. Parentheses can be used up to 15 times in a single level. Calculations within the inner-most set of parentheses will be calculated first.

Calculate: $12 + 42 \div (8 - 6)$

Key in: 12 [+] 42 [÷] [(] 8 [−] 6 [)] [=]

Answer: 33

Calculate: $126 \div [(3 + 4) \times (3 - 1)]$

Key in: 126 [÷] [(] [(] 3 [+] 4 [)] [×] [(] 3 [−] 1 [)] [)] [=]

Answer: 9

[)] [)] can be omitted

Note: The [)] keys located just before the [=] or [M+] key can be omitted. But the opening parenthesis, [(] , must be entered.

Supplementary 1 – priority level

The machine, provided with a function that judges the priority level of individual calculations, permits keys to be operated according to a given mathematical formula.

The following shows the priority level of individual calculations.

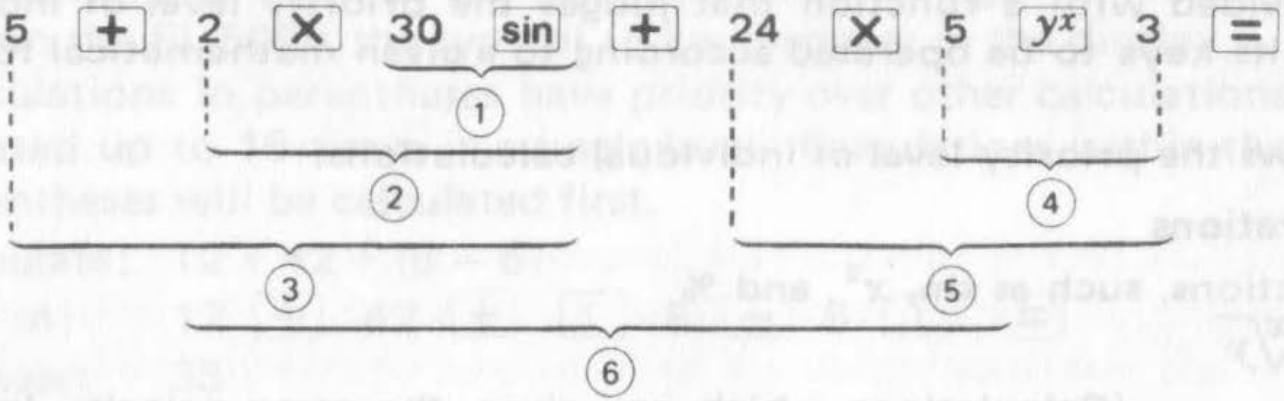
Level	Operations
(1)	Functions, such as sin, x^2, and %
(2)	y^x, $\sqrt[x]{y}$
(3)	x, ÷
(4)	+, −
(5)	=, M+

(Calculations which are given the same priority level are executed in sequence.)

The calculation in parentheses has priority to others.

Ex. Key operation and sequence of calculation in $5 + 2 \times \sin 30 + 24 \times 5^3 = 3{,}006$

Put the angular mode at "DEG" by pressing DRG key.



The numbers ① ~ ⑥ indicates the sequence in which the calculations are carried out.

When calculations are executed from higher priority one in sequence a lower priority one must be reserved. The machine is provided with memories of 4 levels to meet such requirement.

As the memories can also be used in a calculation including parentheses, calculation can be performed according to a given mathematical formula unless parentheses and pending operation exceed 4 levels in total.

- Parenthesis [(] key can be operated up to 15 times in 1 level.
- Functions are calculated immediately after key operation without being retained. (x^2, $1/x$, n!, →DEG, →D.MS, etc.)
- In calculations including no parentheses, pending does not occur beyond 3 levels.

〈 Calculation without using parentheses 〉

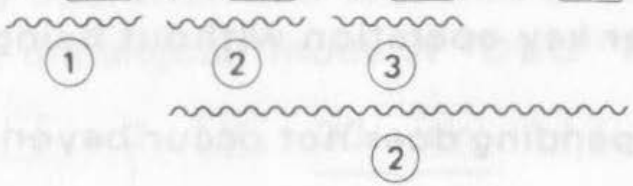
Ex. 1 [+] 2 — Pending of 1 level

① 1 [+] 2 [×] 3 — Pending of 2 levels

① ② 1 [+] 2 [×] 3 [y^x] 4 — Pending of 3 levels

① ② ③

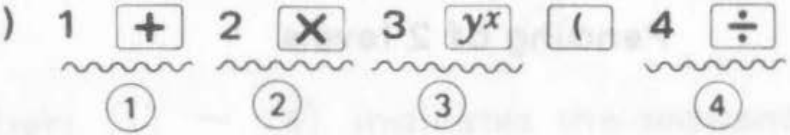
1 [+] 2 [×] 3 [y^x] 4 [÷] 5



With the [y^x] pressed, 3 calculations remain pending. Pressing the [÷] key executes the calculations of "y^x" highest in priority level and "x" identical in priority level. After the [÷] key is pressed, the other 2 calculations will remain.

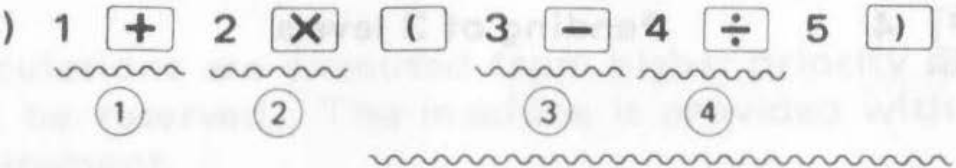
〈 Calculation using parentheses 〉

Ex. i) 1 [+] 2 [×] 3 [y^x] [(] 4 [÷] 5



4 numerals and calculation instructions are left pending.

ii) 1 [+] 2 [×] [(] 3 [−] 4 [÷] 5 [)]



Pressing the [)] key executes the calculation of 3 − 4 ÷ 5 in the parentheses, leaving 2 calculations pending.

- Parentheses can be used unless pending calculations exceed 4. However, parentheses can be continuously used up to 15 times.

  Ex. Parentheses, if continued, can be used up to 15.

  $1 \times (((2 - 3 \times (((4 + 5) \times 6) \div 7$ .....

End of Supplementary 1

4. Memory Calculations

The independently accessible memory is indicated by the three keys: [x→M] , [RM] , [M+] . Before starting a calculation clear the memory by pressing [ON/C] and [x→M] .

Key in: 12 [+] 5 [=] [M+] Answer: 17

To subtract key in: 2 [+] 5 [=] [+/-] [M+]

Answer to this equation: −7

Key in [RM] to recall memory: Display: 10

Key in: 12 [×] 2 [=] [x→M]

Answer: 24 (Replaces previous amount stored in memory with 24.)

Key in: 8 [÷] 2 [=] [M+]

Answer: 4 Key in: [RM] Answer: 28

Note:
- Memory calculations are impossible in the statistical calculation and complex number modes.
- When subtracting a number from the memory, press the [+/−] and [M+] keys.

"MEMORY SAFE GUARD" function — The contents of the memory are retained even when the calculator is turned off. A value stored in memory will thus remain until it is changed or until the batteries run out.

SCIENTIFIC CALCULATIONS

Press the [2ndF] [TAB F↔E] and [•] keys to calculate in the floating decimal system.
(See "Decimal Places" on page 23.)

1. Second Function

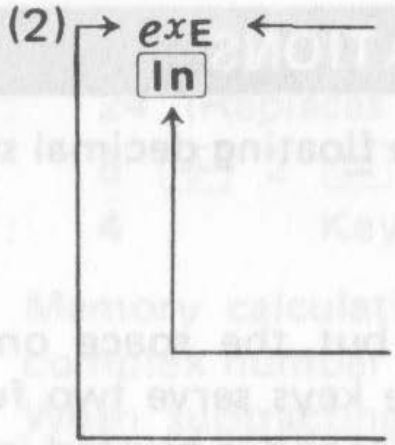
EL-506P has many preprogrammed functions, but the space on the keys to display all the functions is limited. Most of the keys serve two functions: the first function is displayed on the key itself, the second is printed in brown above the key panel.

The yellow key in the upper left of the calculator marked "2nd F" must be used to designate a second function (The material appearing in brown above each key).

Example: (1) [1/x] [x²]

Second function: Use the [2ndF] key. ([2ndF] [1/x])

First function: Press the [x²] key.



Right side: Hexadecimal number (First function)
Press the E key at the hexadecimal mode. (To set the hexadecimal mode, display the symbol HEX by pressing the 2ndF and ▸HEX (−) keys.)

First function: Press the ln key.

Left side: Second function
Use the 2ndF key. (2ndF e^x)

When the 2ndF key is depressed, the designation "2nd F" will appear in the upper part of the display. If you press this key in error, press it a second time and the "2nd F" designation will disappear.

In this manual, we will always shown key functions as follows;

2ndF $\overset{\sin^{-1}}{\sin}$ → 2ndF $\sin^{-1}$ $\qquad$ $\overset{\sin^{-1}}{\sin}$ → sin

2. Scientific Notation

Decimal Places

The [2ndF] [TAB] keys are used to specify the number of decimal digits in the calculation result. The number of places after the decimal point is specified by the numeral key ([0] ~ [9]) pressed after the [2ndF] [TAB] keys. Carry over will be automatically rounded. For free floating calculation press the [•] key after the [2ndF] [TAB] keys.

First press [2ndF] [TAB] [•] Key in: [ON/C] 1.23456789 [=]

Display reads 1.23456789

Press [2ndF] [TAB] [3] , display reads 1.235

Press [2ndF] [TAB] [7] , display reads 1.2345679

Press [2ndF] [TAB] [•] , display reads 1.23456789

Scientific Notation

People who need to deal with very large and very small numbers often use a special format called exponential or **scientific notation**. In scientific notation a number is broken down into two parts.

The first part consists of a regular decimal number between 1 and 10. The second part represents how large or small the number is in powers of 10.

If you wish to place a number into the calculator in scientific notation you must use the [EXP] key. If you wish to convert from floating decimal to scientific notation, you must use the [F↔E] key.

Calculate $1.2 \times 10^{20} \times 1.5 \times 10^{5}$

Key in: 1.2 [EXP] 20 [×] 1.5 [EXP] 5 [=]

Answer: 1.8 25 (1.8×10^{25})

Calculate $1.992 \times 10^{33} \times 6.668 \times 10^{-23}$

Key in: 1.992 [EXP] 33 [×] 6.668 [EXP] 23 [+/−] [=]

Answer: 1.3282656 11 (1.3282656×10^{11})

If a calculation is displayed in the floating decimal point system, pushing the [F↔E] key displays the result in scientific notation. Pushing the key again displays the result in the floating decimal point system.

Key in: [ON/C] 1234567898 [=]
Display reads: 1234567898.
Press [F↔E] Display reads 1.2345678 09
Press [F↔E] Display reads 1234567898.

3. Trigonometric functions

Before starting a calculation, designate a desired angular mode.

The angular mode is designated by the [DRG] key. As you press this key the mode "DEG", "RAD", "GRAD" will appear at the upper part of the display.

Put the angular mode at "DEG".

Calculate: Sin 30° + Cos 40°

Key in the following: 30 [sin] [+] 40 [cos] [=]

Answer: 1.266044443

Calculate: Cos 0.25π

Put the angular mode at "RAD".

Key in: .25 [×] [2ndF] [π] [=] [cos]

Answer: 0.707106781

The designated angular mode is retained even when the calculator is turned off or, at the time of the error.

4. Inverse Trigonometric Functions

Calculate: $\text{Sin}^{-1}\ 0.5$

Put the angular mode at "DEG".

Key in: .5 [2ndF] [sin⁻¹]

Answer: 30

Calculate: $\text{Cos}^{-1}\ -1$

Put the angular mode at "RAD". To enter a negative number, press the [+/−] key after numerals.

Key in: 1 [+/−] [2ndF] [cos⁻¹]

Answer: 3.141592654 (Value of π)

5. Hyperbolic and Inverse Hyperbolic Functions

When using the hyperbolic and inverse hyperbolic functions "HYP" will appear in the upper part of the display.

Calculate: Sinh 4

Key in: 4 [hyp] [sin]

Answer: 27.2899172

Calculate: $\text{Sinh}^{-1}\ 9$

Key in: 9 [2ndF] [archyp] [sin]

Answer: 2.893443986

6. Power Functions

Calculate: 20^2

Key in: 20 [x^2]

Answer: 400

Calculate: 3^3 and 3^4

Key in: 3 [y^x] 3 [=]

Answer: 27

Key in: 3 [y^x] 4 [=]

Answer: 81

7. Roots

Calculate: $\sqrt{25}$

Key in: 25 [$\sqrt{\ }$]

Answer: 5

Calculate: Cube root of 27

Key in: 27 [2ndF] [$\sqrt[3]{}$]

Answer: 3

Calculate fourth root of 81

Key in: 81 [2ndF] [$\sqrt[x]{y}$] 4 [=]

Answer: 3

8. Logarithmic Functions

Calculate: ln 21, log 173

Natural Logarithms: Key in: 21 [ln]

Answer: 3.044522438

Common Logarithms: Key in: 173 [log]

Answer: 2.238046103

9. Exponential Functions

Calculate: $e^{3.0445}$

Key in: 3.0445 [2ndF] [e^x]

Answer: 20.99952881 (21 as in item "8" above)

Calculate: $10^{2.238}$

Key in: 2.238 [2ndF] [10^x]

Answer: 172.9816359 (173 as in item "8" above)

10. Reciprocals

Calculate: 1/6 + 1/7

Key in: 6 [2ndF] [$1/x$] [+] 7 [2ndF] [$1/x$] [=]

Answer: 0.309523809

11. Factorial

Calculate: 69!

Key in: 69 [2ndF] [$n!$]

Answer: 1.7112245 98 (1.7112245×10^{98})

Note that the Error section deals with the calculation limits of the calculator.

12. Percent calculations

Calculate: What is 10% of 200?

Key in: 200 [×] 10 [2ndF] [%] [=]

Answer: 20

Calculate: 9 equals what percent of 36?

Key in: 9 [÷] 36 [2ndF] [%] [=]

Answer: 25 (%)

Calculate: A 10% add-on to 200

Key in: 200 [+] 10 [2ndF] [%] [=]

Answer: 220

Calculate: A 20% deduction on 500

Key in: 500 [−] 20 [2ndF] [%] [=]

Answer: 400

13. Random number generation

Random numbers are useful for "sampling" in statistical calculations.

Each time the [2ndF] and [RND] keys are pressed random numbers are generated.

The range of the generated random number is 0.000 ~ 0.999.

Key in: 2ndF RND

Answer: 0.166

Key in: 2ndF RND

Answer: 0.840

Note:

Since random numbers are literally generated at random, you can not expect the same numbers as shown above.

14. Angle/Time conversions

To convert an angle given as degree/minutes/seconds to its decimal equivalent, it must be entered as integer and decimal, respectively.

Convert 12°47'52'' to its decimal equivalent

Key in: 12.4752 •DEG

Answer: 12.79777778

When converting decimal degrees to the equivalent degrees/minutes/seconds, the answer is broken down: integer portion = degrees; 1st and 2nd decimal digits = minutes; 3rd and 4th digits = seconds; and the 5th and 6th digits = decimal seconds.

Note:

The decimal portion of the result will be displayed in the 6 digits. (except when the integer portion exceeds 5 digits.)

Convert 24.7256 to its degree/minute/second equivalent

Key in: 24.7256 [2ndF] [→D.MS]

Answer: 24.433216 or 24°43'32"

A horse has track times of 2 minutes 25 seconds, 2 minutes 38 seconds, and 2 minutes 22 seconds. What is the average running time?

Key in: .0225 [→DEG] [+] .0238 [→DEG] [+] .0222 [→DEG] [=]

Answer 1: 0.123611111

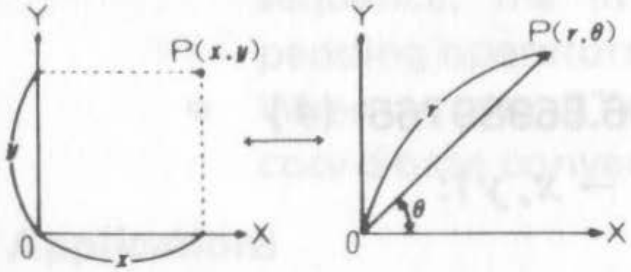
Key in: [÷] 3 [=]

Answer 2: 0.041203703

Key in: [2ndF] [→D.MS]

Answer 3: 0.022833 or the average time is 2 minutes 28 seconds

15. Coordinate Conversion



Rectangular coordinate ⟷ Polar coordinate

$[\rightarrow r\theta\,]$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1}\frac{y}{x}$$

DEG: $0 \leqq |\theta| \leqq 180$
RAD: $0 \leqq |\theta| \leqq \pi$
GRAD: $0 \leqq |\theta| \leqq 200$

$[\rightarrow xy\,]$

$$x = r\cos\theta$$

$$y = r\sin\theta$$

Converting rectangular coordinates to polar $(x, y \rightarrow r, \theta)$:

Solve for $x = 6$ and $y = 4$ mode = DEG

Key in: 6 [a] 4 [b] [2ndF] [→rθ]

Answer: 7.211102551 (r)

Key in: [b] Answer: 33.69006753 (θ)

- Immediately after completing calculation, the value of r can be recalled with the [a] , and the value θ with the [b] .

Calculate the magnitude and direction (phase) in a vector $\dot{I} = 12 + j9$

Key in: 12 [a] 9 [b] [2ndF] [→rθ]

Answer: 15 (r)

Key in: [b] Answer: 36.86989765 (θ)

Converting polar coordinates to rectangular ($r, \theta \rightarrow x, y$):

Solve for P (14, $\pi/3$), r = 14 $\theta = \pi/3$

Mode = RAD Key in: [ON/C] [2ndF] [π] [÷] 3 [=] [b] 14 [a] [2ndF] [→xy]

Answer: 7 (x)

Key in: [b] Answer: 12.12435565 (y)

- Immediately after completing calculation, you can recall the value of x with the [a] , and the value of y with the [b] .
- In this example, the value of π / 3 (value of θ) is first entered. This is because the value entered with the [a] or [b] key is cleared if any arithmetic operation is subsequently done. To avoid this, the value of θ is first determined and entered with the [b] key, then the value of r is entered with the [a] key.

Notes:
- If the [a] or [b] key is operated in a half way of other calculation sequence, the intermediate result obtained up to that time or the pending operators reserved within parentheses ( ) will be cleared.
- When in the STAT, BINARY, OCTAL, or HEXADECIMAL mode, coordinate conversion is not possible.

16. Applications

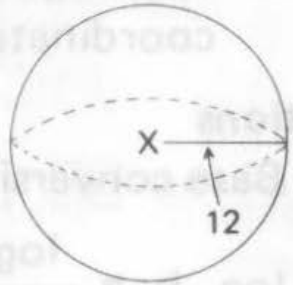
Ex. 1 Base conversion of logarithm

$$\log_a b = \frac{\log b}{\log a} \qquad a = 3,\ b = 124$$

124 [log] [÷] 3 [log] [=]
→ 4.387609364

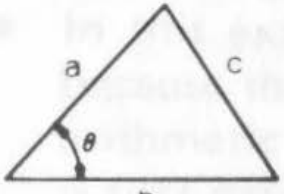
Ex. 2 Calculate the surface and the volume of the sphere.

$S = 4\pi r^2$, $V = \frac{4}{3}\pi r^3$ Radius $r = 12$ cm



4 [×] [2ndF] [π] [×] 12 [x^2] [=]
→ 1809.557368 (S)
12 [y^x] 3 [×] [2ndF] [π] [×]
4 [÷] 3 [=] → 7238.229474 (V)

Ex. 3 Cosine theorem



$c = \sqrt{a^2 + b^2 - 2ab\cos\theta}$

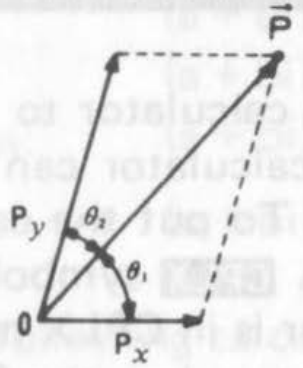
$a = 14.7$ cm, $b = 17.8$ cm,

$\theta = 43°32'54''$

Calculate the length c

DEG mode
14.7 [x^2] [+] 17.8 [x^2] [−] 2 [×]
14.7 [×] 17.8 [×] 43.3254 [→DEG]
[cos] [=] [√] → 12.39480134

Ex. 4 Analyze a vector P into two vectors P_x and P_y.



Supposing that P = 22.5 kg, $\theta_1 = 47°$ and $\theta_2 = 24°$, P_x and P_y are determined as follows;

$$P_x = \frac{P \times \sin \theta_2}{\sin (\theta_1 + \theta_2)} \qquad P_y = \frac{P \times \sin \theta_1}{\sin (\theta_1 + \theta_2)}$$

DEG mode

22.5 [÷] [(] 47 [+] 24 [)] [sin] [×]
24 [sin] [=] → 9.678894424 (P_x)
47 [sin] [=] → 17.403633 (P_y)

COMPLEX NUMBER CALCULATION

Complex number calculation:

To carry out complex number calculations, first set the calculator to the Complex number mode (CPLX mode). In the CPLX mode the calculator can perform the four arithmetic functions, as well as, serial calculations. To put the calculator into CPLX mode press the [2ndF] key and the [CPLX] key. A **CPLX** symbol is displayed on the upper right of the screen to show that the calculator is in CPLX mode.
To clear this mode press the [2ndF] key and the [CPLX] key when the **CPLX** symbol is being displayed. (The **CPLX** symbol will disappear.)

A complex number is represented in the a + bi format. The "a" is the real part while the "bi" is the imaginary part. When inputting the real part, after inputting the number press the [a] key. When inputting the imaginary part, after inputting the number press the [b] key. To obtain the result press the [=] key.

The four arithmetic calculations can be performed using the following format:

Addition: $(a + bi) + (c + di) = (a + c) + (b + d)i$

Subtraction: $(a + bi) - (c + di) = (a - c) + (b - d)i$

Multiplication: $(a + bi) \times (c + di) = (ac - bd) + (ad + bc)i$

Division: $(a + bi) \div (c + di) = \frac{ac + bd}{c^2 + d^2} + \frac{bc - ad}{c^2 + d^2}i$

Perform the following calculations.

Calculate: $(5 + 4i) + (6 + 3i)$

Key in: [2ndF] [CPLX] [ON/C]

5 [a] 4 [b] [+] 6 [a] 3 [b]

[=] Display: 11. (real part)

Key in: [b] Display: 7. (imaginary part)

Answer: $11 + 7i$

Key in: [a] Display: 11. (recall the real part)

Key in: [b] Display: 7. (recall the imaginary part)

- Immediately after completing calculation, you can recall the value of the real part with the [a] key, and the value of the imaginary part with the [b] key.
- A value entered with the [a] or [b] key can be corrected simply by typing in the replacement value followed by operation of the [a] or [b] key.

Example:

5 [a] → Enters 5 as the real part.
4 [b] → Enters 4 as the imaginary part.
6 [a] → Replaces the 5 in the real part with 6.

Calculate: (5 + 4i) − (6 + 3i)
Key in: 5 [a] 4 [b] [−] 6 [a] 3 [b]
[=] Display: −1.
Key in: [b] Display: 1.
Answer: −1 + 1i

Calculate: $(5 + 4i) \times (6 + 3i)$

Key in: 5 [a] 4 [b] [×] 6 [a] 3 [b]

[=] Display: 18.

Key in: [b] Display: 39.

Answer: 18 + 39i

Calculate: $(5 + 4i) \div (6 + 3i)$

Key in: 5 [a] 4 [b] [÷] 6 [a] 3 [b]

[=] Display: 0.933333333

Key in: [b] Display: 0.2

Answer: 0.933333333 + 0.2i

If the complex numbers are represented as polar coordinates, they are to be input in the following manner. (Refer to the Coordinate Conversion section for an explanation on Polar Coordinates.)

r (cos θ + i sin θ)

Key in: r [a] θ [b] [2ndF] [→xy]

Perform the following example problem.

Calculate: 10 (cos 60° + i sin 60°) + 5 (cos 45° + i sin 45°)

Key in: First, using the [DRG] key, set the calculator into the desired angular mode. In this example set it to the DEG mode, next press [2ndF] [CPLX] [ON/C] . (Display the symbol **CPLX** .)

Key in: 10 [a] 60 [b] [2ndF] [→xy] [+]
5 [a] 45 [b] [2ndF] [→xy]
[=] Display: 8.535533906

Key in: [b] Display: 12.19578794

Answer: 8.535533906 + 12.19578794i

If the answer is to be in polar coordinates, the following operation is to be performed.

Key in: [2ndF] [→rθ] Display: 14.88598612 (r)

Key in: [b] Display: 55.01276527 (θ)

Answer: 14.88598612 (cos 55.01276527° + i sin 55.01276527°)

Notes:

- In complex number calculation mode (CPLX mode) the four arithmetic functions and coordinate conversion calculations can be performed.
- In complex calculation mode (CPLX mode) memory calculations, constant calculations, and calculations with parenthesis can not be performed.
- If either "a" or "b" is 0 the calculation can be performed without input. However, if "a" and "b" are both 0, one or the other must be input for one of the four arithmetic functions (+, −, x, ÷) to be carried out.

BINARY, OCTAL, AND HEXADECIMAL NUMBER CALCULATIONS

The EL-506P performs normal calculations with decimal numbers, but may also handle binary, octal, and hexadecimal numbers. When performing calculations in each system, first set the calculator in the desired mode before entering numbers. This calculator performs the following calculations in each mode in the same manner that it performs them in decimal mode: basic calculations, calculations with parenthesis, memory calculations, and constant calculations.

The Mode Setting Operation

Binary system mode (BIN):

Press the [2ndF] and [→BIN] keys.

- To show that the calculator is set in the binary mode, the BIN symbol appears on the top part of the display.
- In this mode each column is either a 0 or a 1. In other words only a 0 or 1 can appear in this position. (The [2] ~ [9] keys become invalid.)

Octal system mode (OCT):

Press the [2ndF] and [→OCT] keys.

- To show that the calculator is set in the octal system, the **OCT** symbol appears.
- In this mode each column can have a value from 0 ~ 7. Thus, only the keys [0] ~ [7] are valid. The [8] and [9] keys become invalid.

Decimal system mode (Normal mode, DEC):

Press the [2ndF] and [→DEC] keys.

- In this mode the following symbols do not appear: **BIN** , **OCT** , and **HEX** .
- In normal mode each column can have the value 0 ~ 9.
- In this mode scientific calculations can be performed.

Hexadecimal system mode (HEX):

Press the [2ndF] and [→HEX] keys.

- To show that the calculator is set in the hexadecimal system, the **HEX** symbol appears.

- In this mode each column can have the values 0 ~ 9 or A(10), B(11), C(12), D(13), E(14), F(15).
- When A ~ F is to be input in HEX mode, if the EXP , y^x , $\sqrt{\ }$, ·DEG , ln , log keys are pressed the letters appearing on the upper right corners will be input.

Now try to convert the decimal values 18 and 63 into the various systems. If the BIN , OCT , or HEX symbol is being displayed, press the 2ndF and ·DEC keys to enter decimal mode.

Conversion to BINary number

Key in: 18 2ndF →BIN — Answer: 10010

2ndF ·DEC 63 2ndF →BIN — Answer: 111111

Conversion to OCTal number

Key in: 2ndF ·DEC 18 2ndF →OCT — Answer: 22

2ndF ·DEC 63 2ndF →OCT — Answer: 77

Conversion to HEXadecimal number

Key in: [2ndF] [→DEC] 18 [2ndF] [→HEX] Answer: 12

[2ndF] [→DEC] 63 [2ndF] [→HEX] Answer: 3F

Now perform "18 + 63" using the values of each system.

Binary system [2ndF] [→BIN] [ON/C] (Clears the previously entered data.)

Key in: 10010 [+] 111111 [=] Answer: 1010001

(If the [2ndF] and [→DEC] are pressed, the results of the decimal system can be viewed.)

Octal system

Key in: [2ndF] [→OCT] [ON/C]

22 [+] 77 [=] Answer: 121

Decimal system

Key in: [2ndF] [→DEC] [ON/C]

18 [+] 63 [=] Answer: 81

Hexadecimal system

Key in: [2ndF] [→HEX] [ON/C]

12 [+] 3F [=] Answer: 51

Examples: Mixed calculations

① Calculate ABCD (hexadecimal number) + 10 (decimal number) and output it in hexadecimal numbers.

Key in: [2ndF] [→HEX] [ON/C] A B C D [+] [2ndF] [→DEC]

10 [=] [2ndF] [→HEX]

Answer: Abd7

Then convert it to the system of the the value to be entered.

② Calculate A B C D (hexadecimal number) x 2 (decimal number) and output it in hexadecimal numbers.

Key in: [2ndF] [→HEX] [ON/C] ABCD [×] [2ndF] [→DEC]

2 [=] [2ndF] [→HEX]

Answer: 1579A

- In the Binary, Octal and Hexadecimal system a negative number will be displayed in the each complement form.

Example: [2ndF] [→DEC] 1 [+/−] → −1.

[2ndF] [→BIN] → BIN 1111111111. (2'complement)

[2ndF] [→OCT] → OCT 7777777777. (8'complement)

[2ndF] [→HEX] → HEX FFFFFFFFFF. (16'complement)

- In the Binary, Octal and Hexadecimal system pressing the [+/−] key changes the number displayed from normal form to complement form or vice versa.

Example: [2ndF] [→BIN] 111 → BIN 111. (7)

[+/−] → BIN 1111111001. (−7)

[+/−] → BIN 111. (7)

Table of Values for Four Base Systems

Decimal	Binary	Octal	Hexadecimal
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5

Decimal	Binary	Octal	Hexadecimal
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10
17	10001	21	11
18	10010	22	12
19	10011	23	13
20	10100	24	14

Notes:

- **Scientific calculations can be performed only in decimal system mode.**
- The number of parentheses that can be used in a single calculation and the level of a pending operation are the same as with decimal system calculation.
- When a decimal number having a fractional part is converted into a binary, octal, or hexadecimal number, the fractional part will be truncated, with only the integer part converted into the respective notation.

  Example: [2ndF] [→DEC] 12.34 [2ndF] [→HEX] → HEX C.
  [2ndF] [→DEC] → 12.

- If the result of conversion is outside the calculation range, an error will result. In this case, however, mode switching is effective.

  Example: [2ndF] [→DEC] 512 → 512.
  [2ndF] [→BIN] → E BIN 0.

- If the result or intermediate result of binary, octal or hexadecimal calculation includes a fractional part, that fractional part will be truncated.

Example: [2ndF] [→OCT] 5 [÷] 2 [=] → OCT 2.

STATISTICAL CALCULATION

- To set the statistical calculations mode, press the [2nd F] and [STAT] keys, the designation " STAT " will appear in the upper part of the display.
- When the statistical calculation mode is set, the following calculations can not be calculated:
  i) Memory calculation
  ii) Coordinate conversion
  iii) Calculation including parenthesis
  iv) Complex number calculation
  v) Binary, octal, hexadecimal number calculation.
- The followings can be used as the input data in statistical calculation:
  i) Entry number
  ii) Calculated result of the functions which can be used in the chain calculation.

- To clear previous statistical inputs and calculation press the 2ndF and STAT keys. Then set the mode by pressing the 2ndF and STAT keys again.
- Reset of the statistical calculation mode can be made by the 2ndF and STAT keys.

Calculate the following statistics.

(1) n: Number of samples

(2) Σx: Total of samples

(3) $\bar{x}$: Mean value of samples ($\bar{x} = \frac{\Sigma x}{n}$)

(4) Σx^2: Sum of squares of samples

(5) s: Standard deviation with population parameter taken to be "n−1".

$$s = \sqrt{\frac{\Sigma x^2 - n\bar{x}^2}{n-1}}$$

(Used to estimate the standard deviation of population from the sample data extracted from that population.)

(6) σ : Standard deviation with populations parameter taken to be "n".

$$\sigma = \sqrt{\frac{\Sigma x^2 - n\bar{x}^2}{n}}$$

(Used when all populations are taken to be sample data or when finding the standard deviation of populations with sample taken to be a populations.)

Data for one-variable statistic calculations are inputted by the following operations.

(1) Data [DATA]

(2) Data [X] Frequency [DATA] (when two or more same data are inputted)

Example:

Calculate standard deviation, mean, and variance (S^2) from the following data:

Value	35	45	55	65
Frequency	1	1	5	2

As each sample is entered the number of that sample will appear on the right hand side of the display.

Key in:	Display:
2ndF STAT	
2ndF TAB •	
35 DATA	1.
45 DATA	2.
55 × 5 DATA	7.
65 × 2 DATA	9.

	Key in:	Display:
Mean ($\bar{x}$):	$\bar{x}$	53.88888889
Standard Deviation (s):	s	9.279607271
Variance:	x^2	86.1111111

Correct Data (CD): The last entry above is an error and must be changed to 60 x 2.

Key in:	Display:
65 × 2 2ndF CD	7.
60 × 2 DATA	9.

ERRORS

In the case of an error, the display will show "E". An error will be caused by a calculations or instruction beyond the capacity of the machine. An error can be cleared by the [ON/C] key.

Supplementary 2 – Error Conditions

1. When the absolute value of a calculation result is greater than or equals to 1×10^{100}.
2. When a number is divided by 0 (zero). (Ex. 5 [÷] 0 [=])
3. When the absolute value of a result of memory calculation is greater than or equals to 1×10^{100}.
4. When the pending operation exceeds 4 levels or when the [(] key is depressed 16 times or more in 1 level.
5. For scientific functions, complex number calculation and binary/octal/hexadecimal number calculation, an error occurs when the calculations exceed the following ranges:

CALCULATION RANGE

- The entry and four (4) arithmetic calculations:
  Entry, 1st operand, 2nd operand: $\pm 1 \times 10^{-99} \sim \pm 9.999999999 \times 10^{99}$ and 0
  Calculated result: $\pm 1 \times 10^{-99} \sim \pm 9.9999999 \times 10^{99}$ and 0
  Note: When the absolute value of an entry and a calculation is less than 1×10^{-99}, the calculator assumes the value is 0.
- Scientific and special functions:

Functions	Dynamic range
$\sin x$ $\cos x$ $\tan x$	DEG: $\lvert x \rvert < 1 \times 10^{10}$ RAD: $\lvert x \rvert < \frac{\pi}{180} \times 10^{10}$ GRAD: $\lvert x \rvert < \frac{10}{9} \times 10^{10}$ – to be continued –

Functions	Dynamic range
$\sin x$ $\cos x$ $\tan x$	In tan x, however, the following cases are excluded. DEG: $\lvert x \rvert = 90\ (2n - 1)$ RAD: $\lvert x \rvert = \frac{\pi}{2}\ (2n - 1)$ (n: integer) GRAD: $\lvert x \rvert = 100\ (2n - 1)$
$\sin^{-1} x$ $\cos^{-1} x$	$-1 \leqq x \leqq 1$
$\tan^{-1} x$	$\lvert x \rvert < 1 \times 10^{100}$
$\ln x$ $\log x$	$1 \times 10^{-99} \leqq x < 1 \times 10^{100}$
e^x	$-1 \times 10^{100} < x \leqq 230.2585092$
10^x	$-1 \times 10^{100} < x < 100$

Functions	Dynamic range
y^x	• $y > 0$: $-1 \times 10^{100} < x \log y < 100$ • $y = 0$: $0 < x < 10^{100}$ • $y < 0$: x: integer or $\frac{1}{x}$: odd number $(x \neq 0)$, and $-1 \times 10^{100} < x \log \lvert y \rvert < 100$
$\sqrt[x]{y}$	• $y > 0$: $-1 \times 10^{100} < \frac{1}{x} \log y < 100, \quad x \neq 0$ • $y = 0$: $0 < x < 10^{100}$ • $y < 0$: x: odd number or $\frac{1}{x}$: integer $(x \neq 0)$, and $-1 \times 10^{100} < \frac{1}{x} \log \lvert y \rvert < 100$
sinh x cosh x tanh x	$-227.9559242 \leqq x \leqq 230.2585092$

Functions	Dynamic range
$\sinh^{-1} x$	$\lvert x \rvert < 1 \times 10^{50}$
$\cosh^{-1} x$	$1 \leqq x < 1 \times 10^{50}$
$\tanh^{-1} x$	$\lvert x \rvert < 1$
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{100}$
x^2	$\lvert x \rvert < 1 \times 10^{50}$
$\frac{1}{x}$	$\lvert x \rvert < 1 \times 10^{100}$, $x \neq 0$
n!	$0 \leqq n \leqq 69$ (n: integer)

Functions	Dynamic range
→DEG →D.MS	$\lvert x \rvert < 1 \times 10^{10}$ ● The function will remain ineffective for any number outside this range (but error symbol "E" will not appear).
$x, y \rightarrow r, \theta$	$\lvert x \rvert < 1 \times 10^{50}$, $\lvert y \rvert < 1 \times 10^{50}$ $x^2 + y^2 < 1 \times 10^{100}$ $\lvert \frac{y}{x} \rvert < 1 \times 10^{100}$
$r, \theta \rightarrow x, y$	$0 \leqq r < 1 \times 10^{100}$, θ is in the same condition as x of sin x, cos x.
DRG ▶	DEG → RAD: $\lvert x \rvert < 1 \times 10^{100}$ RAD → GRAD: $\lvert x \rvert \leqq 1.570796326 \times 10^{98}$ GRAD → DEG: $\lvert x \rvert < 1 \times 10^{100}$

Functions	Dynamic range
→DEC →BIN →OCT →HEX (Conversion)	Converted result: DEC: $\lvert x \rvert \leqq 9999999999$ BIN: $1000000000 \leqq x \leqq 1111111111$ $0 \leqq x \leqq 111111111$ OCT: $4000000000 \leqq x \leqq 7777777777$ $0 \leqq x \leqq 3777777777$ HEX: FDABF41C01 $\leqq x \leqq$ FFFFFFFFFF $0 \leqq x \leqq$ 2540BE3FF
Binary/octal/ hexadecimal number calculation	Entry and calculation result are in the same conditions as above conversion.

Functions		Dynamic range
Complex number		$(A + Bi) \begin{matrix} + \\ - \\ \times \\ \div \end{matrix} (C + Di)$:
	Addition Subtraction	$\lvert A \pm C \rvert < 1 \times 10^{100}$ $\lvert B \pm D \rvert < 1 \times 10^{100}$
	Multiplication	If the result or intermediate result of the calculation $(AC - BD)$ or $(AD + BC)$ is assumed to be "x": $\lvert x \rvert < 1 \times 10^{100}$
	Division	If the result or intermediate result of the calculation $(AC + BD)/(C^2 + D^2)$ or $(BC - AD)/(C^2 + D^2)$ is assumed to be x: $\lvert x \rvert < 1 \times 10^{100}$ (where $C^2 + D^2 \neq 0$)

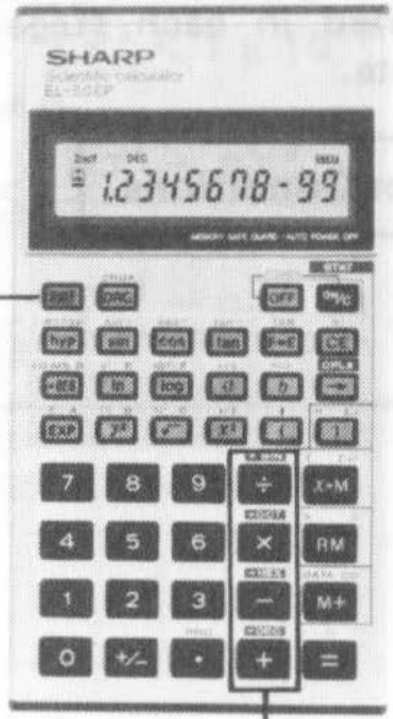
Functions	Dynamic range
Statistical calculation	DATA: $\lvert x \rvert < 1 \times 10^{50}$ CD: $\lvert \Sigma x \rvert < 1 \times 10^{100}$ $\lvert n \rvert < 1 \times 10^{100}$ $\Sigma x^2 < 1 \times 10^{100}$ $\bar{x}$: $n \neq 0$ S : $0 \leqq \dfrac{\Sigma x^2 - n\bar{x}^2}{n-1} < 1 \times 10^{100}$, $n > 1$ σ : $0 \leqq \dfrac{\Sigma x^2 - n\bar{x}^2}{n} < 1 \times 10^{100}$, $n > 0$

For the accuracy of functions other than show above, the error is ±1 at the 10th digit, as a rule. (In the scientific notation system, the error is ±1 at the lowest digit of mantissa display.)
However, the accuracy will become low around singular points and inflection points of functions.

Therefore, errors are accumulated in each stage of the continuous calculations, causing the accuracy to deteriorate.

End of Supplementary 2 — Error Conditions

THE KEYBOARD


SHARP
12345678-99
2nd function designation key
Four arithmetic functions/ binary · octal · decimal · hexadecimal system keys.

1 OFF
2 STAT ON/C
3 2ndF
4 DRG▸ DRG
5 archyp hyp
6 sin⁻¹ cos⁻¹ tan⁻¹ sin cos tan
7 TAB F↔E
8 n! CE
9 ▸D,MS D ▸DEG
10 eˣ E ln
11 10ˣ F log
12 ▸r,θ a
13 ▸xy b
14 CPLX →
15 π A EXP
16 ˣ√y B yˣ
17 ³√ C √
18 1/x x²
19 ↕ (
20 nΣx)
21 0 ~ 9
22 ▸BIN ÷
23 ▸OCT ×
24 ▸HEX −
25 ▸DEC +
26 x̄ Σx² x→M
27 S σ RM
28 DATA CD M+
29 +/−
30 RND •
31 % =

OPERATING CONTROLS

① OFF

Power off key

When this key is depressed, the calculator is turned off.

Automatic Power-Off Function (A.P.O.)

This calculator is automatically turned off approximately 10 minutes after the last key operation to save the batteries.

② STAT ON/C

Power on and clear/startistical calculation mode key

ON/C : Push this key to turn the calculator on. It is ready for operation. When pushed during operation it clears the calculator except for the memory.

2ndF STAT : Statistical program will be activated.
When the calculator is set to the statistical calculation mode through these keys the symbol " STAT " appears, and at the same time the numerical values and calculation commands, except for memory contents are cleared. Meanwhile, in the

statistical calculation mode the [ )], [x→M], [RM] and [M+] keys work as the [n], [$\bar{x}$], [S] and [DATA] keys, respectively. And pushing these keys immediately after the [2ndF] key they work as the [Σx], [Σx^2], [σ] and [CD] keys.

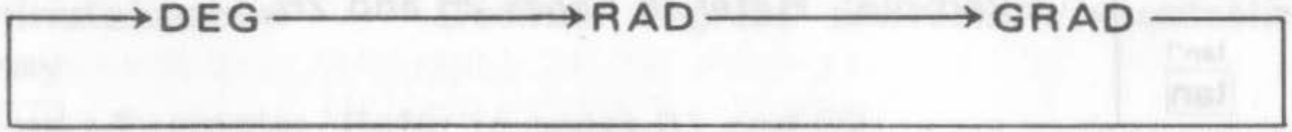
③ [2ndF]

2nd function designation key

④ [DRG▸ / DRG]

Degree/Radian/Grad selector/angular unit conversion key

[DRG] : Used for calculation of trigonometric, inverse trigonometric and coordinate conversion. The [DRG] key changes the angular mode.



(Press [DRG])

Ex. DEG → GRAD: Depress the [DRG] key twice.

"DEG" mode – Entries and answers are in decimal degrees.
"RAD" mode – Entries and answers are in radians.

"GRAD" mode – Entries and answers are in grads.

$(100^g = 90^\circ = \frac{\pi}{2})$

2ndF DRG▸ : It has the function of the DRG key as well as converting the displayed number into a number of the specified angular mode.

(5) archyp hyp

Hyperbolic/arc hyperbolic key

Example: Refer to pages 26 and 27.

(6) $\sin^{-1}$ sin, $\cos^{-1}$ cos, $\tan^{-1}$ tan

Trigonometric/inverse trigonometric function key

Example: Refer to pages 25 and 26.

(7) TAB F↔E

Display format exchange/Tabulation key

F↔E : **When a calculation result is displayed in the floating decimal point system,** pushing the key displays the result in the scientific notation system.

Pushing the key once more displays the result in the floating decimal point system again.

2ndF TAB : Refer to page 23.

⑧ $n!$ / CE **Clear entry/Factorial key**

CE : Used to clear an incorrectly entered number.

123 + 455 CE 456 = → 579.

2ndF $n!$: Calculates the factorial of the displayed number.

Factorial of n(n!) = n · (n−1) · (n−2) ····· 2 · 1

Example: Refer to page 29.

⑨ °'" D / °DEG **Degree/minute/second ↔ Decimal degrees conversion/hexadecimal number key**

°DEG , 2ndF °'" : Example: Refer to pages 31 and 32.

D : Hexadecimal number "D" key.

(effective only in hexadecimal number mode — HEX mode)

(10) e^x E / ln

Natural logarithm/antilogarithm and hexadecimal number key

ln : Used to obtain the logarithm base e (e ≒ 2.718281828).
Example: Refer to page 28.

2ndF e^x : Calculates the antilogarithm base e of the displayed number.
Example: Refer to page 28.

E : HEX mode
Hexadecimal number "E" key.

(11) 10^x F / log

Common logarithm/antilogarithm and hexadecimal number key

log : Used to obtain the logarithm with the base of 10.
Example: Refer to page 28.

2ndF 10^x : Calculates the antilogarithm with the base of 10.
Example: Refer to page 29.

F : HEX mode
Hexadecimal number "F" key.

(12) →rθ / a

Real number enter/coordinate conversion key

a :
- This is used when the real parts of complex numbers are to be inputted and when calling the real parts of calculation results.
- This is used during coordinate conversions when the X coordinate of the Rectangular coordinates (X, Y) is input or when the r of the polar coordinates (r, θ) is input. It is also used for calling the calculated values of X or r.

Example: Refer to page 33.

2ndF →rθ : Converts rectangular coordinate into polar coordinate.
Example: Refer to page 33.

(13) →xy / b

Imaginary number enter/coordinate conversion key

b :
- This is used when the imaginary parts of complex numbers are to be input and when calling the imaginary parts of the calculation results.
- This is used during coordinate conversions when the Y coordinate of the Rectangular coordinates (X, Y) is input or when the θ of the polar coordinates (r, θ) is input. It is also used for calling the calculated values of Y or θ.

Example: Refer to page 33.

2ndF →xy : Converts polar coordinate into rectangular coordinate.
Example: Refer to page 34.

(14) CPLX → Right shift/complex number mode key

→ : Example

	Key in		Display
(1)	12356 → →	→	123.
	45	→	12345.
(2)	5 EXP 24 → →	→	5. 00
	35	→	5. 35

2ndF CPLX : Used to set the complex number mode.
Example: Refer to page 38.

(15) π A EXP Enter exponent/Pi and hexadecimal number key

EXP : Example: Refer to page 24.

2ndF π : The constant π ($\pi \fallingdotseq 3.141592654$) is entered.
Example: Refer to page 25.

A : HEX mode
Hexadecimal number "A" key.

(16) $\sqrt[x]{y}$ B / y^x

Y^x/ $\sqrt[x]{y}$ and hexadecimal number key

y^x : Raises a number to a power.
Example: Refer to page 27.

2ndF $\sqrt[x]{y}$: Calculates the Xth root of Y.
Example: Refer to page 28.

B : HEX mode
Hexadecimal number "B" key.

(17) $\sqrt[3]{}$ C / $\sqrt{}$

Square root/cube root and hexadecimal number key

$\sqrt{}$: Calculates the square root of the number displayed.
Example: Refer to page 27.

2ndF $\sqrt[3]{}$: Calculates the cube root of the number displayed.
Example: Refer to page 28.

C : HEX mode
Hexadecimal number "C" key.

(18) $1/x$ / x^2

Square/reciprocal key

x^2 : Calculates a square of the number displayed.
Example: Refer to page 27.

[2ndF] [1/x] : Calculates the reciprocal of the number displayed.
Example: Refer to page 29.

⑲ [↕ (] **Open parenthesis/exchange key**

[(] : Used to open parenthesis.
Example: Refer to page 11.

[2ndF] [↕] : Used to exchange the number being displayed with the number stored in the working register. $(x \leftrightarrow y)$

⑳ [nΣx)] **Close parenthesis/statistical calculation key**

[)] : Used to close parenthesis.
Example: Refer to page 11.

- When the statistical mode is set,

[n] : Displays the number of samples entered. (n)

[2ndF] [Σx] : Used to obtain the sum of the data (Σx).

㉑ [0] ~ [9] **Numeral keys**
Used to enter numbers.

(22) [→BIN] [÷]

Division/binary number mode key

[÷] : Depressed for division.

[2ndF] [→BIN] : Used to set the binary system mode.
Converts the number displayed into a number in base 2.

(23) [→OCT] [×]

Multiplication/octal number mode key

[×] : Depressed for multiplication.

[2ndF] [→OCT] : Used to set the octal system mode.
Converts the number displayed into a number in base 8.

(24) [→HEX] [−]

Minus/hexadecimal number mode key

[−] : Depressed for subtraction.

[2ndF] [→HEX] : Used to set the hexadecimal system mode.
Converts the number displayed into a number in base 16.

(25) [→DEC] [+]

Plus/decimal number mode key

[+] : Depressed for addition.

2ndF →DEC : Used to set the decimal system mode (normal mode). Converts the number displayed into a number in base 10.

$\bar{x}$ Σx^2

(26) x→M **Memory-in/statistical calculation key**

x→M : Clears the number in the memory and then store the number being displayed in the memory.
To clear the memory depress the ON/C key followed by the x→M key.

- When the statistical mode is set,

$\bar{x}$: Used to obtain the mean value of the data. ($\bar{x}$)

2ndF Σx^2 : Used to obtain the sum of squares of data. (Σx^2)

S σ

(27) RM **Recall memory/statistical calculation key**

RM : Displays the contents of the memory. The contents of the memory remain unchanged after this key operation.

- When the statistical mode is set,

S : Used to obtain the standard deviation of the sample of data.

2ndF σ : Used to obtain the standard deviation of the population of data.

(28) DATA CD M+

Memory plus/DATA CD key

M+ : Used to add the number being displayed or a calculated result to the contents of the memory.
When subtracting a number from the memory, depress the +/– and M+ keys in this order.

- When the statistical mode is set,

DATA : Used to enter the data (numbers).

2ndF CD : Used to correct the mis-entry. (delete function)

(29) +/–

Change sign key

Changes the sign of the number displayed from a positive to a negative or vice versa.

Example 5 +/– → –5.

(30) RND [•] Decimal point/random number key

[•] : Example: 12.3 → [1] [2] [•] [3]

0.7 → [•] [7]

[2ndF] [RND] : These keys are used to generate uniform random numbers from 0.000 to 0.999.

Example: Refer to page 31.

Note: Random number generation is not possible when binary/octal/hexadecimal system mode is set.

(31) % [=] Equals/percent key

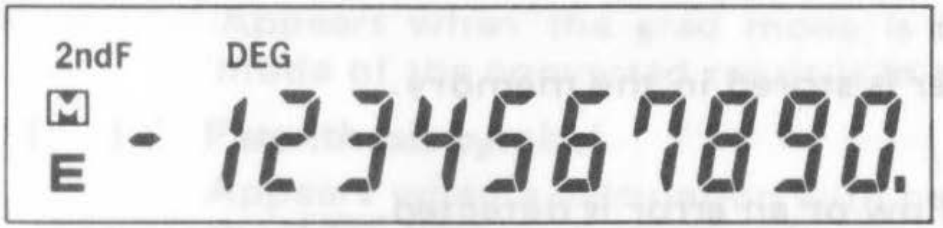
[=] : Completes four arithmetic calculations (+, −, ×, ÷), $\sqrt[x]{y}$, y^x, and complex number calculations.

[2ndF] [%] : Used for the percentage calculation and add-on/discount calculation.

Example: Refer to page 30.

DISPLAY

(1) Display format



(Floating decimal system, normal display)

(Scientific notation system)

Mantissa Exponent

(2) Symbols

− : **Minus symbol**

Indicates that the number in the display following the "−" is a negative.

M : **Memory symbol**

Appears when a number is stored in the memory.

E : **Error symbol**

Appears when an overflow or an error is detected.

2nd F : **2nd function designation symbol**

Appears when the 2nd function is designated.

HYP : **Hyperbolic function designation symbol**

Appears when hyperbolic function is designated.

DEG : **Degree mode symbol**

Appears when the degree mode is designated or shows that the angular mode of the converted result is in degree.

RAD: Radian mode symbol

Appears when the radian mode is designated or shows that the angular mode of the converted result is in radian.

GRAD: Grad mode symbol

Appears when the grad mode is designated or shows that the angular mode of the converted result is in grad.

( ) : Parenthesis symbol

Appears when a calculation with parenthesis is performed by depressing the [( ] key.

BIN : Appears when the binary system mode is set or shows the displayed number is a binary number.

OCT : Appears when the octal system mode is set or shows the displayed number is an octal number.

HEX : Appears when the hexadecimal system mode is set or shows the displayed number is a hexadecimal number.

CPLX : Appears when the complex number mode is set.

STAT : Appears when the statistical calculation mode is set.

(3) Display system

This machine displays a calculation result (x), if it is within the following range, in the floating decimal point system.

$$0.000000001 \leqq |x| \leqq 9999999999$$

And otherwise the machine displays $|x|$ in the scientific notation system. However a calculation result within the above range is also capable of being displayed in the scientific notation system by pressing the F↔E key.

Example: 2ndF TAB 9

• 5 ÷ 9 = → 0.055555556
(The 10th decimal place is rounded.)

F↔E → 5.5555555−02
(The 10th decimal place of the mantissa is rounded.)

F↔E → 0.055555556

2ndF TAB • → 0.055555555

This is determined by the calculator in the form of $5.55555555556 \times 10^{-2}$. Rounding the 11th digit of the mantissa results in $5.555555556 \times 10^{-2}$. When changed to the floating decimal display, the rounded parts may not be displayed as in this example.

BATTERY REPLACEMENT

If the display becomes dark or dim, replace the batteries with new ones according to the following procedure.

Battery: Alkaline manganese battery (Type: LR-44) x 2 or
Silver oxide battery (Type: S15 or SR-44) x 2
(Eveready model S76, Mallory model MS76 and Ray-O-Vac model RS76 or equivalent should be used.)

1. Turn off the calculator.
2. Remove the screws from the back cover with a small screw driver (Fig. 1).
3. Replace the batteries. (Fig. 2) (+ side must be up)
4. Hook the tabs of the back cover into the slits of the calculator proper. (Fig. 3)
5. Push the back cover in slightly while replacing the screws.
6. After the replacement, press the [OFF] and [ON/C] keys in this order to clear the calculator.

   When the batteries are correctly installed " DEG 0." will be displayed. (If the display shows nothing or a meaningless symbol, or the keys become inoperative, remove the batteries and install them again. Press the [OFF] and [ON/C] keys in this order and check the display again.)

Note:
- Wipe off the surface of the new batteries with dry cloth and then install the batteries as shown in Fig. 2.
- Always replace both of the batteries at the same time.

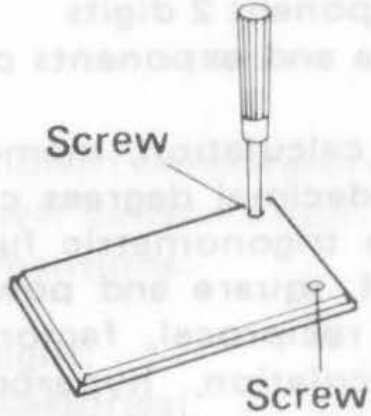


Fig. 1

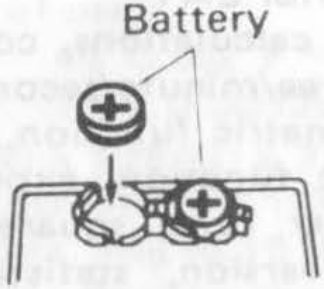


Fig. 2

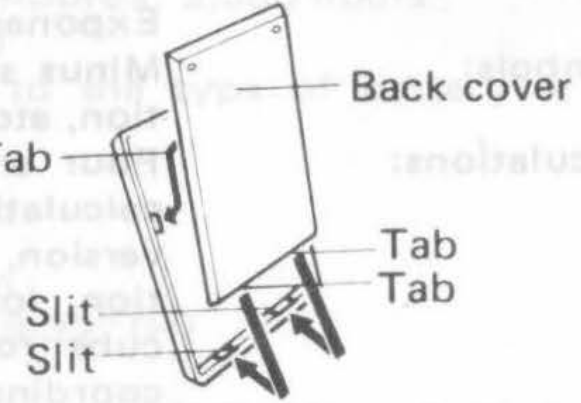


Fig. 3

Keep battery out of reach of children.

SPECIFICATIONS

Model:	EL-506P
Display capacity:	Floating decimal point display: 10 digits or Exponent display: Mantissa 8 digits, Exponent 2 digits
Symbols:	Minus symbol appears both in mantissa and exponents portion, etc. See "DISPLAY"
Calculations:	Four arithmetic calculations, constant calculation, memory calculation, degree/minute/second ⟷ decimal degrees conversion, trigonometric function, inverse trigonometric function, logarithmic function, exponential, square and power, cube root, power root, square root, reciprocal, factorial, coordinates conversion, statistical calculation, hyperbolic and inverse hyperbolic functions, percent calculation, complex number calculation, binary/octal/hexadecimal number calculation, etc.
Component:	LSI etc.

Display:	Liquid crystal (FEM type)
Power supply:	3V ⎓ (DC): Alkaline manganese battery x 2 or silver oxide battery x 2
Operating time:	Alkaline manganese battery (LR-44) Approx. 1,300 hours or Silver oxide battery (SR-44) Approx. 2,500 hours Display 5555. at 20°C (68°F) (Slightly changes according to the type of battery or the way of use.)
Ambient temperature:	0°C ~ 40°C (32°F ~ 104°F)
Power consumption:	3V ⎓ (DC): 0.0002W
Dimensions:	69(W) x 128(D) x 7.5(H) mm 2-23/32"(W) x 5-1/32"(D) x 9-32"(H)
Weight:	Approx. 73g (0.16 lbs.)
Accessories:	Wallet, alkaline manganese battery (LR-44) x 2 (built-in), instruction manual and application book

End of Supplementary 3

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